**Genetics Probs – Advanced Probability**

**Short Answer Question 1**

In humans, pigment production (A) is dominant to albino (a). In a family of three children from a couple, each heterozygous at this gene locus:

1. What is the chance of the offspring being albino – pigmented – albino, in that order?
2. What is the chance of the first three children being pigmented – albino – pigmented, in that order?
3. What is the chance of the first three offspring albino – pigmented – albino OR pigmented – albino – pigmented
4. In a family of four children from parents, each heterozygous at this locus, what is the chance of producing two pigmented children and two albino children?
5. In how many different ways can the combination of two pigmented children and two albino children be obtained in a family of four?

**Short Answer Question 2**

Consider the cross AaBbCcDdEeFf x AabbCCDdEeff

1. What is the chance of producing an offspring with the genotype AaBbCcDdEeFf?
2. What is the chance of producing an offspring with the genotype aabbccddeeff?
3. What is the chance of producing an offspring with the genotype AAbbCCDdEeff?

*Hint: consider each cross as a combination of monohybrid crosses*.

**Short Answer Question 3**

Consider the trihybrid cross DDEErr x ddeeRR

1. How many phenotypic classes would you predict?
2. What is the probability of obtaining DdeeRr?
3. What proportion of offspring would you expect to be homozygous at all three loci?

**Short Answer Question 4**

Two unlinked genes for coat colour in cocker spaniels have the alleles:

B = black coat S = solid colour

B = red coat s = white spots

A solid black male is mated to a solid red female and a litter of five pups results.

1 solid black

2 solid red

1 black and white

1 red and white

1. What is the genotype of each of the parent dogs with respect to these two genes
2. These two dogs have a second litter of seven pups. What is the chance that five pups will be black and two will be red?
3. In the same litter as in b, what is the chance that four of the pups will be solid colour and three will have white pups?

**Short Answer Question 5**

Huntington’s disease is inherited as an autosomal dominant condition that generally develops when a person is about forty years of age. A young woman is advised that her father has just been diagnosed as having Huntington’s disease.

1. What is the chance of the woman developing the disease?
2. The young woman has a baby. What is the chance that the baby will develop the disease?

**Short Answer Question 6**

**Answers**

**Short Answer Question 1**

|  |  |  |
| --- | --- | --- |
|  | A | a |
| A | AA | Aa |
| a | Aa | aa |

**a.** Chance of albino = 1/4; chance of pigmented = 3/4

1/4 x 3/4 x 1/4 = 3/64

b. Chance of albino = 1/4; chance of pigmented = ¾

3/4 x 1/4 x 3/4 = 9/64

c. 3/64 + 9/64 = 12/64

d.



e. 6

**Short Answer Question 2**

a. Aa x Aa Bb x bb Cc x CC

Chance of Aa = 1/2 Chance of Bb = 1/2 Chance of Cc = 1/2

|  |  |  |
| --- | --- | --- |
|  | C | c |
| C | CC | Cc |
| C | CC | Cc |

|  |  |  |
| --- | --- | --- |
|  | B | b |
| b | Bb | bb |
| b | Bb | bb |

|  |  |  |
| --- | --- | --- |
|  | A | a |
| A | AA | Aa |
| a | Aa | aa |

Dd x Dd Ee x Ee Ff x ff

Chance of Dd = 1/2 Chance of Ee = 1/2 Chance of Ff = 1/2

|  |  |  |
| --- | --- | --- |
|  | F | f |
| F | FF | Ff |
| f | Ff | ff |

|  |  |  |
| --- | --- | --- |
|  | E | e |
| E | EE | Ee |
| e | Ee | ee |

|  |  |  |
| --- | --- | --- |
|  | D | d |
| D | DD | Dd |
| d | Dd | dd |

Total probability = (1/2)6 = 1/64

b. Aa x Aa Bb x bb Cc x CC

Chance of aa = 1/4 Chance of bb = 1/2 Chance of cc = 0

Therefore, 0 chance

c. Aa x Aa Bb x bb Cc x CC

Chance of AA = 1/4 Chance of bb = 1/2 Chance of CC = 1/2

Dd x Dd Ee x Ee Ff x ff

Chance of Dd = 1/2 Chance of Ee = 1/2 Chance of ff = 1/4

Total probability = 1/4 x 1/2 x 1/2 x 1/2 x 1/2 x 1/4 = 1/256

**Short Answer Question 3**

a. One

Parents: DDEErr x ddeeRR

Gametes: DEr and deR

Offspring DdEeRr

b. 0

c. 0

**Short Answer Question 4**

a. SsBb and Ssbb

Male must have an s and a b to be able to produce pups with white spots and red pups.

Female must have an s to be able to produce pups with white spots.

b. Parents are Bb and bb, therefore chance of black = 0.5 and chance of red = 0.5



c. Parents are Ss and Ss, therefore chance of solid = 3/4 and chance of spotted = 1/4



**Short Answer Question 5**

a. 50% chance of inheriting the H allele from her father.

b. 1/2 chance she inherits the allele and 1/2 chance her baby inherits it, therefore 1/2 x 1/2 = 1/4.